

**BRITISH COLUMBIA
MINISTRY OF FORESTS AND RANGE**

Tree Farm Licence 49

Riverside Forest Products Ltd.

Rationale for Allowable Annual Cut (AAC) Determination

Effective December 5, 2005

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Objective of this Document

This document is intended to provide an accounting of the factors I have considered and the rationale I have employed in making my determination, under Section 8 of the *Forest Act*, of the allowable annual cut (AAC) for Tree Farm Licence 49. This document also identifies where new or better information is needed for incorporation in future determinations.

Description of Tree Farm Licence 49

Tree Farm Licence (TFL) 49, also referred to as the "Okanagan TFL", is held by Riverside Forest Products Limited (Riverside). Riverside is now a subsidiary of Tolko Industries Ltd. based in Vernon, BC. The TFL has three distinctive blocks (called A, B, and C) with a total area of about 144 000 hectares. TFL 49 is located west of Okanagan Lake near the communities of Kelowna, Vernon and Armstrong. The TFL is administered by the BC Forest Service (BCFS) Okanagan Shuswap Forest District office within the Southern Interior Forest Region.

Approximately 348,000 people live in the Okanagan Shuswap Forest District with about 55 percent of the population residing in the major communities of Kelowna, Vernon, Penticton and Salmon Arm. The district is one of the fastest-growing areas of the province with an estimated 14 percent population increase from 1996 to 2004. Riverside's TFL employees reside in the communities of Kelowna, Westbank, Vernon, Armstrong, Falkland, Westwold and Monte Lake and surrounding rural areas.

Seven First Nations have asserted traditional territories within the TFL. Four bands belong to the Shuswap Nation Tribal Council (Adams Lake, Neskonlith, Little Shuswap, and Spallumcheen). Three First Nations are affiliated with the Okanagan Nation Alliance (Westbank First Nation, Okanagan Indian Band, and Upper Nicola Indian Band).

A key use of Crown lands within TFL 49 is to produce timber within an integrated resource management (IRM) framework. Wildlife, cattle grazing, water values and recreational activities are ranked high in importance in certain parts of the TFL.

The TFL is diverse ecologically with five biogeoclimatic zones. The Interior Douglas-fir (IDF) zone at 37 percent, the Montane Spruce (MS) zone at 34 percent, and the Engelmann Spruce – Subalpine Fir zone at 24 percent, collectively represent about 95 percent of the TFL land base. About four percent of the TFL is in the Interior Cedar – Hemlock (ICH) zone and less than one percent is in the Ponderosa Pine (PP) zone.

The four most common leading tree species in the TFL are present on 95 percent of the timber harvesting land base and consist of lodgepole pine (42 percent), Douglas-fir (27 percent), spruce (13 percent), and subalpine fir (13 percent) which is also referred to as balsam. Other coniferous tree species in the TFL include ponderosa pine, western redcedar and larch, while deciduous species include aspen, birch and cottonwood.

Critical issue: Epidemic mountain pine beetle infestation

Mountain pine beetle epidemics are natural events that affect mainly mature lodgepole pine stands, however, the current infestation has reached an unprecedented level in BC's history. Provincial annual aerial survey data show the beetle affected about 8.5 million

hectares in 2005 increasing from 7 million hectares recorded in 2004. Of the total area affected in 2004, 11 percent sustained severe mortality, 26 percent moderate mortality and 63 percent light or trace mortality.

In determining AACs, the *Forest Act* (section 8(8)(e)) requires consideration of "abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area".

The BC Provincial Scale Mountain Pine Beetle Model was applied to TFL 49 using TFL timber supply analysis data sets. The model projects 2 832 778 cubic metres of timber volume in very severely attacked pine-leading stands by the year 2010. Very severely attacked stands are projected to have greater than 50 percent mortality by volume.

A significant portion of the current AAC in TFL 49 is dedicated to harvesting infested or susceptible lodgepole pine stands. Even so, without an increased harvest level, current efforts are believed insufficient to address projected tree mortality due to the epidemic. There is an opportunity to increase the harvest of currently infested and susceptible stands to enable them to be economically salvaged and reforested. Riverside staff initially requested an AAC increase of 100 000 cubic metres above the AAC in effect at the time they submitted their Management Plan (MP) No. 4 for approval. In May 2005, after reviewing the results of the Provincial Model applied to the TFL data sets Riverside changed its request to an increase of 200 000 cubic metres. I discuss this critical factor including the request for an increase in the AAC further under *mountain pine beetle epidemic*.

History of the AAC

TFL 49 was first issued to Crown Forest Industries in 1985 with an AAC of 380 000 cubic metres during the term of the Management Plan (MP) No. 1, and extensions, from 1986 to 1993. The TFL was assigned to Riverside in 1992. In 1988, 9463 cubic metres of the AAC was allocated to the Small Business Forest Enterprise Program (SBFEP) and this allocation was incrementally increased to 36 905 cubic metres in 1993.

The AAC remained at 380 000 cubic metres in 1994 (which was linked with approval of MP No. 2), in the determination effective December 22, 1998 (linked to the approval of MP No. 3 in 1999), and with the postponement decision on August 26, 2002.

New AAC determination

Effective December 5, 2005, in response to the need to address the mountain pine beetle epidemic, the new AAC for TFL 49 will be 580 000 cubic metres. This AAC is intended to address salvage harvesting of lodgepole pine-leading stands that are, or are susceptible to be, very severely attacked by the mountain pine beetle. This AAC will remain in effect until a new AAC is determined, which must take place within five years of the present determination.

Information sources used in the AAC determination

Key information sources used in this determination include:

- *Proposed Management Plan No. 4: January 1, 2005 – December 31, 2009.* Riverside Forest Products Limited. September 2004;
- *Timber Supply Analysis Report: Okanagan Tree Farm Licence (TFL 49) Management Plan No. 4 Version 3.* Prepared for Riverside Forest Products Ltd. by Timberline Forest Inventory Consultants Ltd. September 2004;
- *Timber Supply Analysis Information Package: Okanagan Tree Farm Licence (TFL 49) Management Plan No. 4 Version 8.* Prepared for Riverside Forest Products Ltd. by Timberline Forest Inventory Consultants Ltd. September 2004;
- *20-Year Spatial Feasibility Analysis: Okanagan Tree Farm Licence (TFL 49) Management Plan No. 4. Version 2.* Prepared for Riverside Forest Products Ltd. by Timberline Forest Inventory Consultants Ltd. September 2004;
- *Okanagan-Shuswap Land and Resource Management Plan.* Province of BC. Completed: September 2000. Approved: April 11, 2001;
- Affidavit between Province of BC and representatives of Adams Lake Band, Spallumcheen Indian Band, Neskonalith Indian Band and Okanagan Indian Band, February 21, 2005, and related affidavit from Dr. Douglas Hudson, October 26, 1999;
- Existing stand yield tables for TFL 49, accepted September 17, 2004;
- Managed stand yield tables and site index curves, accepted October 22, 2004;
- *Tree Farm Licence 49 Rationale for Allowable Annual Cut (AAC) Determination Effective December 22, 1998.* Larry Pedersen, Chief Forester. May 10, 1999;
- *Chief Forester Order Respecting an AAC Determination for Tree Farm Licence No. 49.* Ken Baker, Deputy Chief Forester. August 26, 2002;
- Letter from the Minister of Forests to the chief forester, dated July 28, 1994, stating the Crown's economic and social objectives for the province (see Appendix 3);
- Memorandum from the Minister of Forests to the chief forester, dated February 26, 1996, stating the Crown's economic and social objectives for the province regarding visual resources (see Appendix 4);
- *Forest and Range Practices Act*, 2002 and amendments;
- *Forest and Range Practices Regulations*, 2004 and amendments;
- *Forest Practices Code of British Columbia Act*, 1995, and amendments;
- *Forest Practices Code of British Columbia Act Regulations*, 1995, and amendments;
- Technical review and evaluation of current and expected operating conditions through comprehensive discussions with BCFS staff, including the AAC determination meeting held on October 5th, 2005 and field tour of the TFL by the deputy chief forester on June 14, 2005.

Role and limitations of the technical information used

Section 8 of the *Forest Act* requires the chief forester to consider biophysical as well as social and economic information in AAC determinations. A timber supply analysis, and the inventory and growth and yield data used as inputs to the analysis, typically form the major body of technical information used in AAC determinations. Timber supply analyses and associated inventory information are concerned primarily with biophysical factors—such as the rate of timber growth and definition of the land base considered available for timber harvesting—and with management practices.

However, the analytical techniques used to assess timber supply are necessarily simplifications of the real world. There is uncertainty about many of the factors used as inputs to timber supply analysis due in part to variations in physical, biological and social conditions, although ongoing science-based improvements in the understanding of ecological dynamics will help reduce some of this uncertainty.

Furthermore, technical analytical methods such as computer models cannot incorporate all of the social, cultural and economic factors that are relevant when making forest management decisions. Therefore, technical information and analysis do not necessarily provide complete answers or solutions to forest management problems such as AAC determinations. The information does, however, provide valuable insight into potential impacts of different resource-use assumptions and actions, and thus forms an important component of the information required to be considered in AAC determinations.

In determining the AAC for TFL 49, I have considered known limitations of the technical information provided, and I am satisfied that the information provides a suitable basis for my determination.

Statutory framework

Section 8 of the *Forest Act* requires the chief forester to consider particular factors in determining AACs for timber supply areas (TSAs) and TFLs. Section 8 of the Act is reproduced in full as Appendix 1.

In accordance with Section 23(3) of the *Interpretation Act*, the deputy chief forester is expressly authorized to carry out the functions of the chief forester, which include those required under Section 8 of the *Forest Act*.

The chief forester has expressed the importance of consistency of judgement in making AAC determinations. I also recognize the need for consistency of approach, and I am familiar with the guiding principles that the chief forester has employed in making AAC determinations. I find these principles to be reasonable and appropriate and I have adopted them as described below in making my AAC determination for TFL 49.

Guiding principles for AAC determinations

Rapid changes in social values and in our understanding and management of complex forest ecosystems mean that there is always uncertainty in the information used in AAC determinations. In making the large number of periodic determinations required for British Columbia's many forest management units, administrative fairness requires a reasonable degree of consistency of approach in incorporating these changes and

uncertainties. To make my approach in these matters explicit, I have set out the following body of guiding principles. In any specific circumstance where I may consider it necessary to deviate from these principles, I will explain my reasoning in detail.

Two important ways of dealing with uncertainty are

- (i) minimizing risk, in respect of which in making AAC determinations, I consider particular uncertainties associated with the information before me, and attempt to assess and address the various potential current and future social, economic and environmental risks associated with a range of possible AACs; and
- (ii) redetermining AACs frequently, to ensure they incorporate current information and knowledge -- a principle that has been recognized in the legislated requirement to redetermine AACs every five years. The adoption of this principle is central to many of the guiding principles that follow.

In considering the various factors that Section 8 of the *Forest Act* requires the chief forester to take into account in determining AACs, I intend to reflect as closely as possible operability and forest management factors that are a reasonable extrapolation from current practices. It is not appropriate to base my decision on unsupported speculation with respect either to factors that could work to *increase* the timber supply—such as optimistic assumptions about harvesting in unconventional areas, or using unconventional technology, that are not substantiated by demonstrated performance—or to factors that could work to *reduce* the timber supply, such as integrated resource management objectives beyond those articulated in current planning guidelines or the *Forest Practices Code of British Columbia* – which is now in transition to the *Forest and Range Practices Act*.

In many areas, the timber supply implications of some legislative provisions, such as those for landscape-level biodiversity, still remain uncertain, particularly when considered in combination with other factors. In each AAC determination the chief forester takes this uncertainty into account to the extent possible in the context of the best available information. In making my determination for TFL 49, as deputy chief forester, I have followed the same approach.

As British Columbia progresses toward completion of strategic land-use plans, in some cases the eventual timber supply impacts associated with the land-use decisions resulting from the various regional and sub-regional planning processes remain subject to some uncertainty before formal approval by government. In determining AACs, I will not speculate on timber supply impacts that may eventually result from land-use decisions not yet finalized by government.

In some cases, even where government has made a formal land-use decision, it is not necessarily possible to analyze and account for the full timber supply impact in a current AAC determination. Many government land-use decisions must be followed by detailed implementation decisions requiring, for instance, the establishment of resource management zones and resource management objectives and strategies for those zones. Until such implementation decisions are made it would be impossible to assess in full the overall impacts of land-use decisions. In such cases, the legislated requirement for frequent AAC reviews will ensure that future determinations address ongoing plan

implementation decisions. Whenever specific protected areas have been designated by legislation or order-in-council, these areas are deducted from the timber harvesting land base and are not considered to contribute any harvestable volume to the timber supply in AAC determinations, although they may contribute indirectly by providing forest cover to help in meeting resource management objectives such as biodiversity.

In TFL 49, government approved the Okanagan-Shuswap Land and Resource Management Plan in 2001 which has clarified many aspects of land and resource management and I refer to this where applicable in various components of this document.

When appropriate, I will consider information on the types and extent of planned and implemented intensive silviculture activities as well as relevant scientific, empirical and analytical evidence on the likely magnitude and timing of their timber supply effects.

Some have suggested that, given the large uncertainties present with respect to much of the data in AAC determinations, any adjustments in AAC should wait until better data are available. I agree that some data are not complete but this will always be true where information is constantly evolving and management issues are changing. Moreover, in the past, waiting for improved data created the extensive delays that resulted in the urgency to redetermine many outdated AACs between 1992 and 1996. In any case, the data and models available today are superior to those available in the past, and will undoubtedly provide for more reliable determinations.

Others have suggested that, in view of data uncertainties, the chief forester should immediately reduce some AACs in the interest of caution. However, any AAC determination made by the chief forester or myself must be the result of applying our individual judgement to the available information, taking any uncertainties into account. Given the large impacts that AAC determinations can have on communities, no responsible AAC determination can be made solely on the basis of a response to uncertainty. Nevertheless, in making my determination, I may need to make allowances for risks that arise because of uncertainty.

With respect to First Nations' issues, I am aware of the Crown's legal obligations resulting from decisions in recent years made by the Supreme Court of Canada. I am aware of the Crown's legal obligation to consult with First Nations regarding asserted rights and title in a manner proportional to the strength of their claimed interests and the degree to which the decision may impact these interests. In this regard, I will consider any information brought forward respecting First Nations' aboriginal interests, including operational plans that describe forest practices to address First Nations' interests. As I am able, within the scope of my authority under section 8 of the *Forest Act*, I address those interests. When aboriginal interests are raised that are outside of my jurisdiction, I will endeavour to forward these interests for consideration to other decision-makers.

The AAC that I determine should not be construed as limiting the Crown's obligations under the Court's decisions in any way, and in this respect it should be noted that my determination does not prescribe a particular plan of harvesting activity within TFL 49. It is also independent of any decisions by the Minister of Forests and Range with respect to subsequent allocation of wood supply.

Overall, in making AAC determinations, I am mindful of my obligation as steward of the forest land of British Columbia, of the mandate of the Ministry of Forests and Range as set out in Section 4 of the *Ministry of Forests Act*, and of my responsibilities under the *Forest Practices Code of British Columbia Act* (the Code) and under the *Forest and Range Practices Act* (FRPA).

Because the new regulations of the *Forest and Range Practices Act* are designed to maintain the integrity of British Columbia's forest stewardship under responsible forest practices, it is not expected that the implementation of the legislative changes will significantly affect current timber supply projections made using the Code as a basis for the definition of current practice.

The role of the base case

In considering the factors required under Section 8 of the *Forest Act* to be addressed in this AAC determination, I am assisted by timber supply forecasts provided to me by the licensee as part of the BCFS Timber Supply Review program.

For each AAC determination a timber supply analysis is carried out using an information package including data and information from three categories: land base inventory, timber growth and yield, and management practices. Using this set of data and a computer model, a series of timber supply forecasts is produced. These include sensitivity analyses to assess the timber supply effects of uncertainties or changes in various assumptions around a baseline option, normally referred to as the 'base case' forecast.

The base case forecast may incorporate information about which there is some uncertainty. Its validity, as with all the other forecasts provided, depends on the reliability of the data and assumptions incorporated into the computer model used to generate it. Therefore, much of what follows in the considerations outlined below is an examination of the degree to which all the assumptions made in generating the base case forecast are realistic and current, and the degree to which its predictions of timber supply must be adjusted, if necessary, to more properly reflect the current situation.

These adjustments are made on the basis of informed judgment, using current information available about forest management, which may well have changed since the original information package was assembled. Forest management data are particularly subject to change during periods of legislative or regulatory change, or during the implementation of new policies, procedures, guidelines or plans.

Thus it is important to remember, in reviewing the considerations which lead to the AAC determination, that while the timber supply analysis with which I am provided is integral to those considerations, the AAC determination itself is not a calculation but a synthesis of judgment and analysis in which numerous risks and uncertainties are weighed. Depending upon the outcome of these considerations, the AAC determined may or may not coincide with the base case forecast. Judgments that may in part be based on uncertain information are essentially qualitative in nature and, as such, subject to an element of risk. Consequently, once an AAC has been determined, no additional precision or validation may be gained by attempting a computer analysis of the combined considerations to confirm the exact AAC determined.

Timber supply analysis

The 2004 timber supply analysis for TFL 49 was prepared by Timberline Forest Inventory Consultants Limited under the direction of Riverside staff. Timberline used its Critical Analysis of Schedules for Harvesting – version 6.21 (CASH6) model for the timber supply analysis. Based on my staff's experience examining results from this model, I am satisfied that it is capable of providing reasonable projections of timber supply.

The base case in the timber supply analysis incorporates a number of changes in input data and methodology from the base case generated in the previous timber supply analysis that supported the AAC determination effective December 22, 1998. These differences include the use of:

- inventory volume adjustments based on Vegetation Resource Inventory (VRI) Phase 2 sampling in mature natural stands;
- improved site index estimates for managed stands;
- genetic gains from planting stock in future managed stand yield curves;
- higher utilizations standards;
- refined assumptions regarding old growth retention consistent with the Okanagan-Shuswap Land and Resource Management Plan (OS-LRMP).

Due to these and other changes, the current and previous base case projections are not directly comparable in some respects. Comprehensive details of the assumptions made in representing current forest management in TFL 49 in the base case are provided in the 2004 timber supply analysis report and many are also discussed in relevant sections of this rationale.

In the base case, the harvest flow objectives included maintaining or increasing the current AAC for as many decades as possible, limiting changes in harvest levels to less than ten percent per decade, and achieving a maximum even-flow long-term supply where the growing stock is stable.

The resulting base case forecast indicates that the initial harvest level of 385 900 cubic metres per year can be sustained for 70 years. This initial harvest level is 1.6 percent higher than the current AAC of 380 000 cubic metres. In decade eight the harvest forecast increases by 27 percent to the long-term level of 488 600 cubic metres per year.

From my review of the timber supply analysis, including discussions with BCFS analysts, I am satisfied that the base case forecast provides a suitable basis of reference for use in my considerations in this determination. In addition to the base case forecast, I was provided with alternative harvest flows, and a number of sensitivity analyses carried out using the base case as a reference. Mountain pine beetle-related harvest flow scenarios were also provided. All of these analyses, and others as noted below, have been helpful in the considerations and reasoning leading to my determination, which are documented as follows.

Consideration of Factors as Required by Section 8 of the *Forest Act*

Section 8 (8)

In determining an allowable annual cut under this section the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider

(a) the rate of timber production that may be sustained on the area, taking into account

(i) the composition of the forest and its expected rate of growth on the area

Land base contributing to timber harvest

- general comments

The general area of TFL 49 is estimated to be 144 345 hectares. About 2951 hectares are now in protected areas, 7133 hectares after previous deductions are considered non-forest or non-productive forest and 1826 hectares after previous deductions are in existing roads, trails and landings. This leaves a total productive forest land base of 132 435 hectares within the TFL boundary.

About 8678 hectares (seven percent) of the net Crown productive forestland base within the TFL was assumed in the base case to be unavailable for timber harvesting in the timber supply analysis. The main reasons that forests are unavailable on TFL 49 are because they are considered to be non-merchantable, necessary to retain for riparian management or to address other environmentally sensitive values. The current area estimated in the base case to be economically and environmentally suitable for harvesting—the ‘timber harvesting land base’—therefore covers 123 757 hectares (93 percent of the productive forest).

Forests within the areas deducted from the productive land base do not contribute to timber supply but do contribute in the analysis to meeting a variety of non-timber resource objectives such as wildlife, visual quality and biodiversity.

Deriving the timber harvesting land base includes making a series of deductions from the productive forest land base to account for factors that effectively reduce the suitability or availability for harvesting of the productive forest area for economic or ecological reasons. In timber supply analysis, assumptions, and if necessary, projections, must be made about these factors, prior to quantifying appropriate areas to be deducted from the productive forest area to derive the timber harvesting land base. A detailed accounting of the areas deducted is given in the 2004 timber supply analysis (also called the “analysis”). My consideration of these deductions follows. The “total area” deducted refers to the entire area of the factor deducted from the land base, while the “net area” refers to deductions made after accounting for other overlapping area exclusions.

In my considerations of the uncertainties that may exist in the estimating the timber harvesting land base, I am mindful of a sensitivity analysis that assessed the impact of increasing or decreasing the timber harvesting land base by five percent. A five percent increase allowed a 4.5 percent increase in timber supply throughout the forecast period.

When the timber harvesting land base was reduced by five percent, the initial harvest level attained in the base case could be maintained for the first three decades, followed by a ten-percent drop to the mid-term level until decade seven, before reaching a long-term harvest level that is five percent below the base case.

- protected areas

Fintry Provincial Park was designated in April 2001 and the 2951-hectare portion of the protected area that lies within the TFL was excluded from the timber harvesting land base in the base case. I accept this exclusion from the timber harvesting land base as appropriate given that the park has been formally designated.

- non-forest and non-productive forest

About 5161 hectares of non-forest (including open range, urban areas, lakes, swamps and a variety of other non-forest types) and 1972 hectares of non-productive forest were excluded from the timber harvesting land base in the base case. This represents the best available information from existing inventories which I accept as appropriate for use in this determination.

- roads, trails and landings

In the analysis, separate estimates were made to reflect reductions to the timber harvesting land base already incurred by existing roads trails and landings, and those to be expected in the future.

Reductions to the land base assumed in the 2004 timber supply analysis for existing roads, trails and landings were based on road and trail lengths determined from the licensee's spatial Road Information Management System (RIMS) and assumed widths based on the type of road or trail in RIMS. For example, 1615 kilometres of secondary logging roads with an assumed width of eight metres led to a 1293 hectare total area reduction, whereas 154 kilometres of secondary trails with a three-metre width led to a 46 hectare reduction. Existing landings identified in RIMS were buffered using a 25 metre radius (i.e. an assumed area of 0.2 hectares per landing). This led to a 1778-hectare reduction for roads and trails, and a 48-hectare reduction to the land base for landings - or an 1826-hectare net area reduction for existing roads, trails and landings.

BCFS staff contend that the widths applied to roads and trails in the base case were too narrow since the licensee indicated that the assumed widths accounted for the running surface and ditches, but not the clearing width that may be permanently denuded of forest cover. District staff estimate the widths should be two metres wider for trails, six metres for secondary logging roads, five metres for main logging roads, and from seven to ten metres for highways. The additional widths would increase the reductions to 3508 hectares instead of the 1826 hectares assumed. The 1682-hectare additional area is equivalent to 1.4 percent of the timber harvesting land base.

The licensee based its estimate of future roads, trails and landings on its Total Chance Plan (TCP) where proposed roads were identified. Some of the proposed roads have been constructed since the TCP was prepared for MP No. 3. In the analysis, these newly constructed roads were assumed to be 'existing roads' while an estimated 730 hectares net area were deducted in the long-term to account for 'future roads'. Future roads are

expected to be built within 40 years and this timeline was factored into the analysis. No explicit deductions were made for future landings as the analysis assumed that the eight-metre width applied to secondary roads would account for this factor.

As with existing roads, BCFS district staff believe the widths for future roads are underestimated and should be increased by six metres (from eight metres assumed to 14 metres) for secondary roads to better account for lost productive forest area. This would result in a 1277 hectare land base reduction for this factor rather than the 730 hectares assumed in the analysis. The 547 hectares of potentially unaccounted for future road area represents about 0.4 percent of the timber harvesting land base.

I accept the BCFS staff assessment that accounting for this factor in the base case likely overestimated the timber harvesting land base by 1.4 percent due to existing roads, trails and landings and that this represents an overestimate of timber supply throughout the harvest forecast. In addition, accounting for future roads, trails and landings represents a 0.4 percent overestimate of timber supply in the long term. I will discuss this further under "Reasons for Decision".

- non-commercial areas

All land classified in the inventory as having no commercial tree species cover was appropriately excluded from the timber harvesting land base. The area excluded amounted to 75 hectares.

- recreation reserves

Recreation reserves include reserves for the use, recreation and enjoyment of the public (UREPs) established under *the Land Act*. A total of 1396 hectares of recreation reserves, mainly UREPs, exist in the TFL, and this total area was deducted from the land base (of the deducted area, 1090 hectares were already excluded in the analysis due to other factors).

Riverside recognizes in its proposed MP No. 4 that recreation use is important in the TFL, and is committed to integrating its forest management activities in a manner that allows for maintaining current levels of satisfactory user-days of recreation use.

BCFS staff believe the best available information to account for recreation reserves was used in the base case. I concur and accept that this factor was appropriately accounted for in estimating the timber harvesting land base.

- non-merchantable stands

Non-merchantable stands (or problem forest types) are not expected to be economically utilizable due to low volumes or poor quality. In the base case, a net area of 285 hectares was excluded to account for overstocked pine stands, 210 hectares to account for stands with low productivity, 1100 hectares for stands with low volumes and 1195 hectares to account for deciduous-leading stands that the licensee is not utilizing. In addition, deciduous volumes in conifer-leading stands were excluded from the yield tables used in the base case.

BCFS staff believe these land base exclusions reasonably reflect current practice on the TFL. Although some interest has been expressed by others to harvest deciduous volumes

on the TFL, this does not reflect current practice. Should there be future utilization of deciduous species, this can be factored into subsequent determinations. Meanwhile, I accept the accounting for this factor as appropriate and make no adjustments on this account in this decision.

- environmentally sensitive areas and operability

Environmentally sensitive areas (ESAs) were mapped for the entire TFL in 1991. ESAs classified as highly sensitive due to potentially severe regeneration problems, and as sensitive or unstable soils, were entirely excluded from the timber harvesting land base. This led to a net exclusion of 1710 hectares from the timber harvesting land base following previous exclusions.

Riverside believes timber harvesting constraints applied for wildlife habitat in the analysis (see *wildlife habitat*) better accounts for current wildlife management strategies than the outdated ESA mapping for wildlife.

Except for areas deducted for soils, the licensee assumed in the analysis that the entire TFL productive forest land base is operable. This assumption reflects the commitment made by Riverside in MP No. 3 and 4 to harvest steep slopes, if necessary with unconventional harvesting methods including helicopter logging.

Having reviewed this factor with staff, I am concerned about the use of relatively old 1991 ESA mapping to account for unstable soils when more up-to-date terrain stability mapping techniques exist and have often been undertaken in other management units. The licensee has a project underway to upgrade terrain stability information for the TFL. Under "Implementation", I note the importance of completing this project so that better information is available to account for unstable soils in support of the next determination. For this determination, I accept the information used to account for this factor in the base case, since it reflects the best information available at this time.

- riparian management areas

Riparian management areas (RMAs) along lakes, wetlands, and streams and rivers provide key habitat for fish and wildlife and help conserve water quality and biodiversity. The Code and the FRPA provide for RMAs which include riparian reserve zones (RRZs) that exclude timber harvesting and riparian management zones (RMZs) that can constrain timber harvesting.

Riparian classification for lakes within TFL 49 was derived from two different sources. First, use was made of a lake classification project undertaken by various agencies that had reviewed all lakes greater than five hectares in size using the advice provided in the 1996 BCFS regional *Lakes Classification and Lakeshore Management Guidebook*. Second, selected lakes less than five hectares in size as identified by the district manager and Ministry of Environment were considered and many of these lakes were assigned a distinctive management class. In the analysis, a ten-metre RRZ was deducted around all of these lakes (i.e. both the ones greater than five hectares, and those less than five hectares that were classified). The OS-LRMP provides visual quality direction (see *lakeshore management zones*) around these lakes which is intended to address additional needs for lakeshore management as it might affect timber supply.

For the timber supply analysis, the licensee used the *Riparian Management Area Guidebook* RRZ and RMZ widths, and retention objectives in the RMZs, for any lakes not classified as a result of the above processes as well as for wetlands, and streams and rivers. For the analysis retention requirements in RMZs were converted into an "effective RRZ" (or buffer width), with no harvesting allowed, to reduce the complexity of modelling RMZ basal area retention objectives.

The OS-LRMP also provides direction for enhanced riparian management beyond those normally provided for as described above. As outlined in the LRMP, TFL 49 is to provide for 1236 hectares of enhanced riparian reserves (ERRs). This was partially accounted for through six hectares of explicitly mapped ERRs, 304 hectares for S4 fish-bearing streams, and 399 hectares for S5 streams. Since the location of the remaining 527 hectares of ERRs has not yet been mapped, these were accounted for in the analysis by increasing RRZs around streams by 20 percent.

According to MP No. 4, although most streams in the TFL have been classified based on field verification using the RMA Guidebook, many streams have not been formally classified. In these instances, assumptions applied in the analysis were based on the knowledge provided by Riverside's staff. Riverside states in its MP that it is committed to completing an inventory of streams, wetlands and lakes to Guidebook standards.

I encourage Riverside under "Implementation" to complete this task as this will help improve timber supply analyses that support future determinations. I accept the assumptions used to account for this factor in the base case for this decision since they are based on best currently available information.

- wildlife tree patches

A total of 670 hectares of existing wildlife tree patches (WTP) have been mapped on TFL 49 and were excluded from the timber harvesting land base. I accept this deduction as it reflects current practice. The accounting in the base case for wildlife tree retention needed to address future harvesting is discussed under *stand-level biodiversity: wildlife tree retention*.

- Kelowna dirt bike club

An 11-hectare area was excluded from the timber harvesting land base to address a ten-year licence of occupation held by the Kelowna dirt bike club; the area then reverts back to the land base at year 11 in the analysis. I accept these assumptions regarding the land base.

Existing forest inventory

Vegetation Resource Inventory (VRI) is the current provincial standard for gathering forest inventory information. VRI generally consists of two phases: phase 1 based on photo interpretation, and phase 2 consisting of ground sampling. The most recent forest cover inventory, completed in 2002 to VRI standards, was used in the analysis. Phase 2 ground sampling completed on the TFL was used to adjust the phase 1 forest cover attribute estimates. The inventory is in a fully digital spatial format and is compatible with the provincial inventory database.

The inventory data used in the analysis was updated by Riverside for disturbance, regeneration and silviculture to September 2003. Once updated, the inventory attributes were then projected for growth to September 2003.

VRI phase 2 for the TFL consisted of 85 plots, with 67 in mature forests older than 80 years of age and 18 plots in immature forests between 60 and 80 years of age. The samples in mature forests were used to adjust stand height, age and volume in the inventory using standard procedures. The fewer number of samples in immature forests were not sufficient to justify volume adjustments.

Adjustments resulted in volume increases of 3.3 percent for mature pine-leading stands, 22.4 percent for mature Douglas-fir leading stands, and 23.6 percent for other mature leading stands. This led to an average volume increase of 9.3 percent for mature natural stand volumes based on VRI phase 2 sampling.

Using the forest inventory and other information, a total of 471 analysis units were identified based on leading species, site productivity, biogeoclimatic ecosystem classification (BEC) site series and management objectives. This ecological approach resulted in 368 distinctive analysis units for existing unmanaged (natural) stands, 53 units for existing managed stands, and 50 units for future managed stands. Existing and unmanaged stand yield tables were generated for each of these analysis units in support of the timber supply analysis.

In reviewing this factor with BCFS staff, I accept the volume adjustments as appropriate for use in this determination as they are based on best available information using standard adjustment procedures. Since the adjustments significantly affect short-term timber supply availability, under "Implementation", I request that this factor be monitored to ensure its appropriateness for future determinations. The aggregation procedures used to derive analysis units appear to be appropriately undertaken in the analysis.

- volume estimates for existing unmanaged stands

In the timber supply analysis, estimates of timber volumes in existing unmanaged stands were projected using the Variable Density Yield Prediction (VDYP) model version 6.6d. Unmanaged stands were assumed to be those that are at least 36 years of age.

Yield tables for existing unmanaged stands were generated using area weighted average species composition, site index and crown closure from the inventory polygons. The aggregate analysis unit volumes for existing mature stands compared well (they were one percent higher) with the corresponding aggregate inventory polygon volumes.

Inventory volumes were increased to account for VRI phase 2 sampling as previously discussed. Yield tables for existing unmanaged stands were accepted by the then Ministry of Sustainable Resource Management in September 2004.

The licensee provided a sensitivity analysis in which it assessed the effects of increasing or decreasing unmanaged stand yield volumes. A ten-percent increase enabled an immediate nine-percent increase in the short-term harvest level to decade seven relative to the base case. With a ten percent decrease, the initial harvest level attained in the base case could be maintained for two decades, however the harvest level then declined by

nine percent until decade seven when it increased to a long-term harvest level that equalled the base case long-term harvest level. Alternatively, the analysis could have shown an immediate reduction in the initial harvest level and a smaller mid-term reduction.

Unmanaged (natural) stand yields were modelled in the base case using standard procedures that were accepted by government. I therefore find their use appropriate in support of this determination.

Expected rate of growth

- site productivity estimates

Inventory data include estimates of site productivity for each forest stand, expressed in terms of a site index. The site index is based on the stand's height as a function of its age. The productivity of a site largely determines how quickly trees grow. This in turn affects the time seedlings will take to reach green-up conditions, the volume of timber that can be produced, and the ages at which a stand will satisfy mature forest cover requirements and reach a merchantable size.

The most accurate estimates of site productivity come from stands between 30 and 150 years of age. The growth history of stands less than 30 years of age is often not long enough to give accurate measurements of site productivity. Estimates derived from older stands underestimate site productivity as these stands are often well past the age of maximum height growth and have often been affected by disease, insects and top damage as they reach advanced age. The underestimate of site productivity based on forest inventory estimates for older stands have been verified in several studies (e.g. Old-Growth Site Index or OGSi study) in the province. These studies have confirmed that when old stands are harvested and regenerated, site productivity realized is generally higher than what inventory-based site index estimates of older stands would predict.

In order to derive a better estimate of site productivity for existing and future regenerated managed stands, Riverside derived site index estimates using Site Index Biogeoclimatic Ecosystem Classification (SIBEC) and Predictive Ecosystem Mapping (PEM). The project was completed in 2002 and findings approved by BC Forest Service Research Branch staff in 2003. The findings from the project allowed an average increase of four metres in site index. This resulted in an average 26 percent increase in volume expected from regenerated stands compared to using site indices based on existing natural stands using VRI age and height.

In reviewing this factor, I find the adjustments made to site productivity estimates are consistent with accepted procedures and I am satisfied that their use in the base case for TFL 49 is appropriate. Given the importance of this factor in assessing timber supply, under "Implementation", I request that these assumptions be monitored to ensure they are appropriate for use in future determinations.

- volume estimates for regenerated managed stands

In the analysis, the standard BCFS growth and yield model Table Interpolation Program for Stand Yields or TIPSy (version 3.0h) was used to estimate the timber volumes for

regenerated managed stands. The model was applied to all future regenerated stands and to all existing stands 35 years old or less. Major inputs to the TIPSYS model include species composition, regeneration delay, site index, operational adjustment factors and genetic worth of planting stock. The site productivity estimates previously discussed were used to provide site index.

The TIPSYS projections are initially based on ideal conditions, assuming full site occupancy and the absence of pests, diseases and significant brush competition. However, certain operational conditions, such as a less-than-ideal distribution of trees, the presence of small non-productive areas, endemic pests and diseases, or age-dependent factors such as decay, waste and breakage, may cause yields to be reduced over time. Two operational adjustment factors (OAFs) are therefore applied to yields generated using TIPSYS, to account for losses of timber volume resulting from these operational conditions. OAF 1 is designed to account for factors affecting the yield curve across all ages, such as small stand openings. OAF 2 accounts for factors whose impacts tend to increase over time such as pests, disease, decay, and waste and breakage.

In the timber supply analysis for TFL 49, an OAF1 reduction of ten percent was assumed to account for gaps in stocking, and a standard provincial reduction for OAF2 of five percent was used to account for decay and pests.

Riverside believes setting OAF1 reductions at ten percent rather than using standard provincial reductions of 15 percent is more appropriate for TFL 49 due to the use in the analysis of the recently developed Vegetation Resource Inventory (VRI). The VRI provided a better resolution (to a minimum of 0.5 hectares or less) for mapping non-productive polygons compared to the larger polygons identified in older forest cover mapping for which standard OAF reductions are typically applied. However, no explicit documentation has been provided substantiating the lower OAF reductions, as previously requested by the chief forester in the last determination in 1998.

Sensitivity analysis was undertaken in which volume estimates for regenerated managed stands were increased and decreased. Increasing managed stand yields by ten percent allows a nine percent higher long-term harvest level and a ten-year earlier transition from the initial harvest level to a higher long-term level relative to the base case. Decreasing managed stand yields by ten percent results in a ten percent reduction in the harvest level during a transition period between decades five to seven as well as a nine percent reduction in the long-term harvest level relative to the base case.

Although I acknowledge that there is some uncertainty in OAF reductions applied in the analysis, I also recognize that some uncertainty in this factor does not put short-term harvest levels at risk. However I am concerned that the mid-term timber supply projected in the base case may be overestimated if the OAF 1 estimate is too low. Under "Implementation", therefore, as the chief forester did in the 1998 determination, I request that the licensee substantiate OAF adjustments before the next analysis.

- genetic worth

Use of select seed with improved genetic traits can increase timber volumes of managed stands in the long term and quicken the time for a stand to reach a green-up height or reach minimum harvestable age. The quantity and quality (genetic worth) of select seed

available in the province has increased in the past decade, and is projected to increase further. Licensees are required to use select seed when available.

Riverside has been using select seed on the TFL since 1992 and has a seed orchard where both an Engelmann spruce and lodgepole pine select seed is produced.

In the analysis Riverside modelled its expected use of select seed as described in draft MP No. 4. Genetic gains were applied to managed stand yield tables based on a variety of factors including seed planning unit elevation bands, seed planning zones and associated biogeoclimatic ecosystem classification units, and species plans.

The long-term weighted volume gains attributed to the use of select seed ranged from 12 to 16 percent and these were applied in the derivation of future managed stand yield tables. BCFS Research Branch staff reviewed the projected volume gains and no concerns were raised.

For this determination, I conclude that the base case reasonably reflects the use of select seed on the TFL. Any uncertainty in this factor mainly affects timber supply in the mid-to long-term and does not pose an undue risk to short-term timber supply. Nevertheless, there is a need to monitor seedling performance to assess if the projected gains reasonably reflect actual practice. I raise the need to monitor this factor under "Implementation" given its importance in influencing timber supply.

- minimum harvestable ages

A minimum harvestable age is an estimate of the earliest age at which a forest stand has grown to a harvestable condition. The minimum harvestable age assumption mainly affects when second growth stands will be available for harvest within the timber supply model. This, in turn, affects how quickly existing stands may be harvested such that a stable flow of timber harvest may be maintained. In practice, many forest stands will be harvested at much older ages than the minimum harvestable age, due to economic considerations or forest cover constraints on harvesting that arise from managing for such values as visual quality, wildlife and water quality.

Minimum harvestable ages assumed in the base case were based on the age at which stand volume reaches at least 95 percent of its culmination of mean annual increment (CMAI). This ranged from 70 to 160 years of age for existing (natural) stands and from 50 to 120 years of age for managed stands.

A sensitivity analysis was provided in which the impact of increasing or decreasing minimum harvestable ages for existing (natural) stands was projected. If the minimum harvestable age is increased by ten years, the harvest level is not affected from decade one to four, and then decreases by three percent from decades five to seven relative to the base case with no effect in the long term. A ten-year reduction in assumed minimum harvestable ages provides a minimal improvement (less than 1 percent) in the harvest level to decade seven with no effect in the long term relative to the base case. The minimal impact of increasing or decreasing minimum harvestable ages of existing stands reflects the fact that the majority these stands are older than the minimum harvestable age assumed in the analysis.

Increasing minimum harvestable ages for existing and future managed stands by ten years results in a 13 percent reduction in the harvest level from decade three to seven with no impact in the short or the long term relative to the base case. Decreasing the minimum harvestable ages for managed stands by ten years results in a ten-percent increase in the short- and mid-term compared to the base case. The long-term harvest level, however, declines by nine percent because stands are harvested in the model before their full productive potential is reached.

While there is considerable uncertainty around the choice of minimum harvestable ages, based on analysis results I am satisfied that this uncertainty does not pose an undue risk to timber supply in the short term since harvesting is currently being undertaken in stands much older than the minimum harvestable ages assumed in the analysis. I therefore accept the assumptions applied in the base case on this account as the best available information for this determination.

- (ii) **the expected time that it will take the forest to become re-established on the area following denudation:**

Regeneration delay

Regeneration delay is the period between harvesting and the time at which an area becomes occupied by a specified minimum number of acceptable, well-spaced seedlings. Planting and use of natural regeneration are both practiced on the TFL. In the timber supply analysis, a regeneration delay of two years was assumed for all species other than Douglas-fir and naturally regenerating pine. For these a four-year delay was assumed.

The licensee provided a sensitivity analysis in which uncertainty in this factor was assessed. Increasing the assumed regeneration delay by five years reduced the harvest forecast by six percent from decade five to decade eight and by eight percent in the long term relative to the base case. There was no effect in the short term. Setting regeneration delay at zero years allowed short- and mid-term harvest levels to increase by one percent and the long-term level to increase by three percent compared to the base case.

BCFS district staff consider the regeneration delays assumed in the base case appropriate and I accept their use for this determination.

Not-satisfactorily-restocked areas

Not-satisfactorily-restocked (NSR) areas are those areas where timber has been removed, either by harvesting or by natural causes, and a stand of suitable trees and stocking has yet to be established. Where a suitable stand has not been regenerated and the site was harvested prior to 1987, the classification is 'backlog' NSR. All other NSR is considered 'current' NSR.

According to the inventory, a total of 1563 hectares of NSR exist on the TFL which represents about 1.3 percent of the timber harvesting land base. This amounts to about 1.4 years of harvest based on about 1130 hectares of annual harvest during decade one in the analysis. In the model NSR areas were assigned a stand age of zero years. I am

satisfied that this factor was appropriately modelled in the base case and make no adjustments in my determination on this account.

(iii) silvicultural treatments to be applied to the area:

Silvicultural systems

The silvicultural harvest systems predominately used on TFL 49 are clearcut or clearcut with reserves, and use of these systems was assumed in the analysis. BCFS staff believe this appropriately reflects current and expected practice for the purposes of modelling timber supply since only a small area is harvested using other silvicultural systems. I therefore accept that the base case has appropriately accounted for this factor for the purposes of this determination.

Regeneration

Regeneration strategies detailed in proposed MP No. 4 that are reflected in the analysis are based on the Predictive Ecosystem Mapping (PEM) work undertaken by the licensee. Although the ecologically-based regeneration strategies used in the analysis seem reasonable, given the magnitude of the current mountain pine beetle epidemic and its associated impacts on timber supply and the environment, I encourage the licensee to consider planting alternatives to pine, where feasible, in an effort to mitigate potential future mountain pine beetle outbreaks.

Incremental silviculture

In general, incremental silviculture includes activities such as commercial thinning, juvenile spacing, pruning and fertilization that are not part of the basic silviculture obligations required to establish a free-growing forest stand following timber harvesting. Riverside has no plans for incremental silviculture activities on the TFL in the short-term and none was assumed in the analysis. I am therefore satisfied that this factor was appropriately addressed in the base case.

(iv) the standard of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area:

Utilization standards

Utilization standards define the species, dimensions and quality of trees that are harvested and removed from an area during harvesting operations. In the analysis, a 20-centimetre maximum stump height and 10-centimetre minimum top diameter was assumed for all species. In addition, for lodgepole pine, a 12.5 centimetre minimum diameter at breast height (DBH), and for all other species, a 17.5 centimetre DBH, was assumed. These assumptions are standard utilization levels and are reflected in most timber supply reviews in comparable TSAs and TFLs in the interior, with the notable exception of stump height, which is normally assumed to be 30 centimetres.

Riverside indicates that it has been harvesting to 20-centimetre maximum stump heights during MP No. 3 as standard practice on the TFL. A volume increase of 1.9 percent was assigned to yield tables in the analysis to account for this higher level of utilization. Although no documentation was provided to support this adjustment, appropriate BCFS staff accepted the unmanaged and managed yield tables including the adjustment.

I acknowledge that there is some uncertainty with respect to how best to account for the higher utilization levels that reportedly occur in the TFL, however I accept the adjustments made in the base case for the purposes of this determination. Under "Implementation", I request that this factor be substantiated by the licensee in support of future determinations.

Decay, waste and breakage

The VDYP model used in the timber supply analysis to project volumes for existing unmanaged stands incorporated estimates of volumes of wood lost to decay. Waste and breakage factors were applied in the analysis using the factors for the Forest Inventory Zone and Public Sustained Yield Unit where the TFL is located. These estimates of losses have been developed for different areas of the province based on field samples. As previously discussed, OAFs were used in the analysis to account for decay, waste and breakage in the yield tables for regenerated managed stands.

I am satisfied that appropriate procedures were followed to account for decay, waste and breakage in the base case. However, I encourage the licensee to review the net volume adjustment factors developed for use with the VRI and to endeavor to use this new approach for the next determination.

- (v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production:

Integrated resource management objectives

The Ministry of Forests and Range is required under the *Ministry of Forests Act* to manage, protect and conserve the forest and range resources of the Crown and to plan the use of these resources so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are co-ordinated and integrated. Accordingly, the extent to which integrated resource management (IRM) objectives for various forest resources and values affect timber supply must be considered in AAC determinations.

The analysis for TFL 49 has addressed some IRM objectives through reductions in the timber harvesting land base. I have accounted for these factors in 'Land base contributing to timber harvesting.' In this section, I account for IRM objectives where the land base continues to contribute to timber supply but various forest cover and adjacency constraints, or yield reductions are applied.

- cutblock adjacency, forest cover and green-up

To manage for resources such as water, wildlife and scenic areas, and to avoid concentrating harvesting-related disturbance in particular areas, operational practices limit the size and shape of cutblocks and maximum disturbances (areas covered by stands of less than a specified height), and prescribe minimum green-up heights required for regeneration on harvested areas before adjacent areas may be harvested. Green-up requirements help to achieve objectives for water quality, wildlife habitat and visual resources. Adjacency, green-up and forest cover objectives guide harvesting practices to

provide for a distribution of harvested areas and retained forest cover in a variety of age classes across the landscape.

In the analysis for TFL 49, in order to represent the desired conditions necessary to meet the various objectives in different areas consistent with the OS-LRMP, the timber harvesting land base was zoned for different values such as scenic areas, community watersheds and wildlife habitat where varying forest cover requirements apply. These are discussed later for each of these values.

For the general IRM zone, which covers about 85 percent of the TFL area, the OS-LRMP identifies the need for a two-metre green-up and this was modelled in the analysis. The licensee also assumed a maximum allowable disturbance of 33 percent in the IRM zone. The IRM adjacency constraint did not limit annual harvest at any time throughout the entire harvest forecast period. A sensitivity analysis that assessed the impact of increasing or decreasing allowable disturbance limits by five percent had no impact on harvest levels over the forecast period.

A sensitivity analysis was also undertaken related to green-up in the IRM zone and other management zones. If the assumed green-up height is increased by one metre, the initial harvest level is not affected. The mid-term level is reduced by three percent and the long-term is minimally reduced relative to the base case. A one metre decrease in the assumed green-up height allows a one percent increase in harvest levels in the short- and mid-term with no impact on the long-term.

Having reviewed this information with BCFS staff, I am satisfied that the base case appropriately accounted for green-up and cutblock adjacency in the IRM zone, as it generally reflects the direction in the OS-LRMP.

- scenic areas

The Code and FRPA enable scenic areas to be designated and visual quality objectives (VQOs) to be established so that the visible evidence of forest harvesting can be kept within acceptable limits.

Three visual landscape management zones are identified in the OS-LRMP. Recommendations for Zone 1 call for the legal establishment of scenic areas and VQOs and this has been completed in the LRMP area including the TFL. The assigned VQOs were modelled in the analysis. Requirements for Zones 2 and 3 do not call for establishment of scenic areas and management in these areas is not believed to measurably impact timber supply on the TFL, therefore no specific forest cover requirements were applied in the analysis for these zones.

Specific assumptions regarding maximum allowable visible alteration (disturbance) and visually effective green-up (VEG) height were made for different portions of Zone 1 based on VQO class and visual absorption capability (VAC). For example, for retention VQOs with low VAC the licensee assumed no more than ten percent allowable alteration and a five-metre VEG, while for modification VQOs with a high VAC it assumed up to 35 percent allowable alteration and a three-metre VEG. Scenic areas with VQOs (i.e. Zone 1 areas) cover about 16 percent of the productive land base in the TFL.

Sensitivity analysis was undertaken to assess the effect on timber supply of increasing or decreasing allowable disturbance levels. Increasing allowable disturbance by five percent in non-IRM zone areas (i.e. areas zoned for VQOs, community watersheds and wildlife habitat) resulted in a one percent increase in short-term timber supply. Decreasing allowable disturbance by five percent reduced mid-term timber supply by about seven percent but with no effect in the short or long term. The sensitivity analyses suggest that some adjustment in allowable disturbance does not appreciably affect short-term timber supply.

Although BCFS staff note a potential minor discrepancy in assumed allowable disturbances for VQOs in the base case relative to the guidance provided in the OS-LRMP, based on the results of the sensitivity analysis I am satisfied that no adjustment to this determination is necessary on this account.

- identified wildlife

The province's Identified Wildlife Management Strategy (IWMS) addresses plant communities and species at risk, and regionally significant species. "Identified wildlife" are those wildlife species and plant communities that have been established as requiring special management.

Identified wildlife can be protected through the establishment of wildlife habitat areas (WHAs) with objectives or general wildlife measures. The objectives or general wildlife measures may preclude or constrain timber harvesting activity depending on the requirements of individual identified wildlife species or communities.

Government policy direction limits the timber supply impact of the IWMS to one percent. Operational policy direction has been to initially allocate the one-percent impact equally to each forest district with acknowledgement that this approach can be refined if warranted. Impacts greater than one percent can still be addressed by government if required to protect species at risk, but using other tools such as land use decisions.

In the OS-LRMP a 7500-hectare budget of timber harvesting land base for the entire LRMP area is discussed for the protection of identified wildlife and rare elements. The available "element occurrence" spatial data from the Conservation Data Centre was reviewed by the licensee and no rare species or plant communities are known to lie within the TFL. Consequently, no accounting for identified wildlife was made in the timber supply analysis.

Given the review of existing data, I am satisfied that for the purposes of this determination this factor was addressed appropriately in the base case. If future decisions are made by government regarding the management of identified wildlife and species at risk that result in impacts on timber supply that are different than those assumed in the base case, this can be accounted for in subsequent determinations.

- wildlife habitat

The OS-LRMP identifies wildlife resource management zones, and various forest cover constraints were applied to these areas in the analysis.

In moose winter range, at least 33 percent of the productive forest land base need to be covered with stands at least 16 metres in height. Moose winter range covers about 20 percent of the productive forested area on the TFL and is therefore a particularly important species with respect to timber supply. Similar forest cover constraints apply to bighorn sheep habitat which is less prevalent on the TFL.

For mule deer winter range, various snow pack zones are identified with distinctive minimum old forest retention requirements. For example, in deep snow pack areas, at least 60 percent of productive forest lands need to be in forest cover over 100 years of age. In shallow snow pack areas, at least 15 percent of productive forest lands need to be in forest cover over 140 years of age and no more than 30 percent can be less than 20 years of age.

In mountain goat winter plateau habitat, no more than 33 percent of productive forest lands can be covered with forests less than 33 years of age and a 150-year rotation age is assumed in the analysis for non-pine leading forests and 100 years for pine-leading stands.

A very small portion of martin habitat resource management zone identified in the OS-LRMP occurs on the TFL (about four percent of the zone). The licensee felt it was impractical to account for this small area in the timber supply analysis.

In reviewing this factor with BCFS staff, I am satisfied that the assumptions used in the base case to account for wildlife habitat is appropriate for use in this determination.

- community watersheds

There are five community watersheds (Hope Creek, Lambly Creek, Norris Creek, Powers Creek, and a small portion of Silver Creek) which total about 25 050 hectares (about 20 percent) of the timber harvesting land base in the TFL. In the analysis, forest cover constraints were assumed in all community watersheds to address conservation of water resources. Current practice in community watersheds limits harvesting to a maximum equivalent clearcut area (ECA) of 30 percent based on total forested area. This was modelled in the analysis by limiting the percent of productive forests that could be smaller than a hydrologic green-up height of six metres; the limit ranged from 30 percent to 42.5 percent depending on the watershed.

A sensitivity analysis assessed the impact of further constraining the area of the productive forests that could be below six metres in height from one percent to 30 percent depending on the watershed. These changes reduced the mid-term harvest level by three percent but did not impact short- or long-term timber supply.

BCFS staff believe the base case appropriately accounted for this factor for the purposes of this determination and I concur with this assessment.

- lakeshore management

Lakeshore management zones and objectives were established under the CODE and continue to apply under the FRPA. The lakeshore management zone includes a 200-metre wide zone around classified lakes.

In order to address the objectives for lakeshore management zones, forest cover requirements were identified in the analysis for each zone based on lake classification, visual quality objective and visual absorption capability. This led to a maximum allowable visible alteration and visually effective green-up (VEG) height being specified for each zone.

In reviewing this factor with BCFS staff, I am satisfied that lakeshore management has been appropriately modelled in the base case.

- landscape-level biodiversity: old forest retention

Achieving landscape-level biodiversity objectives involves maintaining forests with a variety of patch sizes, seral stages, and forest stand attributes and structures, across a variety of ecosystems and landscapes. Managing for biodiversity is based in part on the principle that maintaining these conditions—together with connectivity of ecosystems and the maintenance of forested areas of sufficient size to maintain forest interior habitat conditions—will provide for the habitat needs of most forest and range organisms.

Old forest retention objectives have been legally established for the OS-LRMP area, including TFL 49, as part of a provincial non-spatial old growth order. The objectives provide retention levels consistent with the OS-LRMP recommendations including that the entire area covered by TFL 49 be assigned the low biodiversity emphasis option (BEO). Old forest retention targets in hectares are provided in the order by landscape unit, natural disturbance type and biogeoclimatic unit for areas both within and outside the timber harvesting land base. These legal objectives were modelled in the base case.

An important old forest retention issue yet to be resolved in the OS-LRMP area, including the TFL, relate to the draw-down of retention objectives for low biodiversity emphasis option areas.

It is important to resolve this issue before the next timber supply review to allow for a current accounting of old forest retention in the TFL. For now, I am satisfied that the timber supply analysis has reasonably accounted for old forest retention as legal requirements in place at the time of the analysis were modelled. I do not believe uncertainty in this factor will pose a consequential risk to short-term timber supply, particularly in light of other key factors that affect this determination such as the mountain pine beetle epidemic.

- stand-level biodiversity: wildlife tree retention

Wildlife tree patches (WTPs) are an important part of stand-level biodiversity and the Code and FRPA both provide for the retention of wildlife trees in harvested areas. As discussed under *wildlife tree patches*, 670 hectares of existing and mapped WTPs were excluded from the timber harvesting land base.

To account for WTPs in future harvested areas in the analysis, yield reductions were applied by landscape unit and biogeoclimatic subzone considering the productive forest area, the timber harvesting land base, the amount of previous harvesting history, and the area greater than 250 metres from existing WTPs. This led to net wildlife tree retention

percentages ranging from 2.3 percent to 6.3 percent, and averaging 5.2 percent, applied as yield reductions for future harvested stands.

BCFS staff conclude that this factor was adequately accounted for in the base case. Although I concur in the context of the base case, I raise concerns about retention levels later under *mountain pine beetle epidemic* in the context of large scale salvage operations.

- (vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber;

Other information

- harvest sequencing

In timber supply analysis, the order in which eligible stands are assumed to be harvested can affect the projected timber supply in a number of ways. Any difference between the modelling assumptions made and the order in which stands are actually harvested in operational practice must be examined and accounted for.

In the timber supply analysis model for TFL 49, forest stands with the most years over a minimum harvest age are harvested first. This "relative oldest first" harvest rule gave no particular focus on species profile.

The focus of recent harvesting has been on lodgepole pine-leading stands that have been infested or are susceptible to infestation by the mountain pine beetle populations. This is also expected to be the focus of harvesting in the future over the next five years. This issue is addressed under *mountain pine beetle epidemic* where scenarios are explored that do target pine-leading stands.

- twenty-year plan

Riverside prepared a *20-Year Spatial Feasibility Analysis* report in support of the draft MP No. 4 document for TFL 49. This spatial analysis sets out a hypothetical sequence of harvesting over a 20-year period using the assumptions that supported the base case. All approved blocks from existing forest development plans are used in the harvest scheduling assignments. The spatial analysis is not intended to be an operational plan but does demonstrate that harvest blocks can be identified that achieve base case harvest levels for the first 20-years.

- Okanagan-Shuswap Land and Resource Management Plan

Strategic plans such as the OS-LRMP provide context and direction for forest operational planning by providing objectives for the management of various forest resources. The OS-LRMP process was initiated in 1995 with the final plan approved by Cabinet in 2001. The OS-LRMP consists of maps of resource management zones and text providing resource management objectives and strategies for the entire LRMP area as well as additional objectives and strategies that are specific to each zone. Implementation of the plan is enabled through various legal tools and through the recommendations and guidance it provides.

I am aware that current practices in the TFL are guided by the recommendations arising from the OS-LRMP, and that these recommendations were used in the development of the timber supply analysis. I have discussed this in the various factors described in this document and am satisfied that the direction in the OS-LRMP is satisfactorily reflected in the base case that I am considering in support of this determination.

- First Nations considerations, and archaeological and cultural heritage values

Seven First Nations have asserted traditional territories within the TFL. Four bands belong to the Shuswap Nation Tribal Council (Adams Lake, Neskonlith, Little Shuswap, and Spallumcheen). Three First Nations are affiliated with the Okanagan Nation Alliance (Westbank First Nation, Okanagan Indian Band, and Upper Nicola Indian Band).

A variety of information sources were used in the timber supply review to help address First Nation's interests and archaeological and cultural heritage values. These included:

- Adams Lake and Neskonlith Traditional Use Study;
- Archaeological Inventory Survey of Little Shuswap Traditional Territory Year One (1999);
- Archaeological Inventory Survey of Little Shuswap Traditional Territory within the Salmon Arm Forest District – An Investigation of Aboriginal Trails (2001);
- An Archaeological Overview Assessment of Woodlots in the Vernon Forest District (1997);
- Archaeological Impact Assessment Investigations in the Vernon and Salmon Arm Forest Districts (1997);
- Text Draft – Final Report: Trail Inventory in Riverside Forest Products Ltd. Armstrong Division TFL 49B Operating Area, Upper Nicola Indian Band Traditional Territory (2002); and
- information concerning each First Nation that was obtained through the information sharing and consultation process in 2004 and 2005.

In 2004, Riverside contacted the First Nations listed above with two letters regarding MP No. 4, the information package and the timber supply analysis. In these letters, Riverside provided websites and compact discs where these documents could be found, and encouraged the First Nations to provide written comments. In the second letter Riverside made specific mention of its request for an increase of the AAC to manage the mountain pine beetle epidemic. Riverside further indicated it would contact the First Nations to arrange to meet with them to discuss the plan and the request for an increased AAC. Several First Nations accepted the invitation and met with Riverside.

In 2005, as part of the consultation process, the Okanagan Shuswap Forest District contacted all First Nations with asserted territories on the TFL by letter about the pending decisions regarding MP No. 4 and the AAC. In the letter, the district summarized the information sharing process that had taken place between Riverside and the First Nations, and the concerns that had been raised by First Nations to the date the letter was sent. The district encouraged First Nations to inform them of their aboriginal interests and specific

locations of such interests that they believe may be affected by the MP and the AAC determination. The district also offered to meet with First Nations. The district followed-up on their initial contact with each First Nation.

New information pertaining to aboriginal interests within TFL 49 received through the consultation process and information sharing conducted by Riverside was mainly limited to general assertions of aboriginal title and rights.

The Neskonlith Indian Band expressed a desire to protect birch stands and First Nations trails and sites in Block C within the TFL. I note that all deciduous-leading stands and the deciduous component of coniferous-leading stands were excluded in the analysis, and so this determination should not impact the future availability of birch stands. I further note that archaeological sites are protected under the *Heritage Conservation Act*. While no area on TFL 49 is currently identified as an archaeological site, should any be identified in the future, there is an opportunity to locate land base exclusions for other resources, such as Wildlife Tree Patches, OGMAS and Riparian Reserves to provide the appropriate buffers around these sites. First Nations trails can be protected in a similar manner.

In previous attempts to collect information on TFL 49 it was found that the area has been used historically by aboriginal people. Most notable is the reported abundance of trails and trail networks, particularly in the Salmon River area, as noted in the draft Final Report: Trail Inventory in Riverside Forest Products Ltd. Armstrong Division TFL 49B Operating Area, Upper Nicola Indian Band Traditional Territory (2002). This report was not completed and contains limited information on the location and extent of the trails, however, when trails are identified during the archaeological impact assessment process, they are protected using wildlife tree patches and riparian reserve zones.

In general there is a lack of Traditional Use Study (TUS) information that would better allow for the quantification of the land base that may be subject to traditional uses on TFL 49. TUS work to identify traditional uses for the Tahaetkun Mountain area, where First Nations indicate a sacred site exists, is underway and the findings of this study should be considered in future timber supply analysis for the TFL. It is currently unknown how much the Tahaetkun area contributes to base case harvest levels. Given the size of the TFL, the contribution is likely to be small. As a consequence any uncertainty regarding the contribution of this area to timber supply should not pose an undue risk to short-term timber supply. The findings of this TUS and Riverside's management strategies for the sacred site and surrounding area can be incorporated into future AAC determinations.

As I noted above, no reductions or constraints were applied in the analysis specifically for archaeological sites. Riverside has established protocols for archaeological assessments with all First Nations except Westbank. Riverside indicates that the protocols result in their entire cutting permit being assessed rather than individual cutblocks.

Portions of TFL 49 include areas (e.g. Browns Creek area) that are subject to current litigation involving the Okanagan Bands, and the province. I am aware of aboriginal interests and uses asserted in the affidavits and which are relevant to this litigation,

including the use of trees for various cultural purposes. I do not believe this AAC determination will impact these asserted interests and uses. For example, First Nations can apply for a free use permit under the *Forest Act* for the use of trees for cultural and traditional purposes.

During the consultation process, other issues, not related to aboriginal interests, were raised by First Nations that are outside the scope of an AAC determination such as the allocation of any uplift volumes to First Nations, BC Forest Service policy regarding accommodation, and the hiring of First Nations contractors.

Forest and Range Agreements (FRAs) are interim agreements between BCFS and eligible First Nations. They are designed to provide for workable accommodation of aboriginal interests that may be impacted by forestry decisions during the term of the agreement, until such time as those interests are resolved through treaty. FRAs may provide First Nations with a direct award forest tenure and a share of forestry revenues. All of the First Nations with asserted traditional territories on the TFL have been offered FRAs and three First Nations have signed agreements (Westbank First Nation, Little Shuswap and Upper Nicola Indian Bands).

In reviewing First Nations considerations, to the extent that specific interests have been raised that might affect timber supply, I believe I have addressed the issues as they relate to my area of authority in determining an AAC. In the future, I would like to be provided with more specific information to better identify aboriginal interests and how these interests might be impacted by subsequent proposed AAC determinations.

I acknowledge Riverside's efforts to better determine potential impacts on archaeological resources through the protocols they have established with First Nations, as this provides an opportunity to help ensure operational decisions address these important values. If issues are identified that significantly vary from the assumptions made in this determination, I am prepared to revisit this determination sooner than the five years required by legislation.

(b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area;

- *Alternative harvest flows*

The nature of the transition from harvesting old growth to harvesting second growth is a major consideration in determining AACs in many parts of the province. In keeping with the objectives of good forest stewardship, AACs in British Columbia have been and continue to be regularly determined to ensure that short-term harvest levels are compatible with a smooth transition to medium and long-term levels. Timber supplies need to remain sufficiently stable so that there are no inordinately adverse impacts on current or future generations. To achieve this, the AAC determined must not be so high as to cause later disruptive shortfalls in supply nor so low as to cause immediate social and economic impacts that are not required to maintain forest productivity and future harvest stability.

In the base case, the harvest flow objectives included maintaining or increasing the current AAC for as many decades as possible, limiting changes in harvest levels to less than ten percent per decade, and achieving a maximum even-flow long-term supply where the growing stock is stable.

Two alternative harvest flows were provided. An even-flow harvest forecast was provided where harvest levels would not change throughout the forecast period. This alternative flow indicates that the initial harvest level attained in the base case (385 900 cubic metres per year) can be maintained indefinitely.

Another harvest flow tested the impact of increasing the base case initial harvest level by ten percent to 425 900 cubic metres per year for the first decade. Relative to the base case, this caused a two percent decline in the mid-term harvest level to 376 900 cubic metres per year from decades two to seven before increasing to the same long-term harvest level attained in the base case.

I have considered the base case forecast and these alternative harvest flows in my determination, particularly given the mountain pine beetle epidemic confronting timber supply in the TFL.

- (c) the nature, production capabilities and timber requirements of established and proposed timber processing facilities;

This section of the *Forest Act* was repealed in 2003. [2003-31-2 (B.C. Reg. 401/2003)]

- (d) the economic and social objectives of the government, as expressed by the minister, for the area, for the general region and for British Columbia;

Minister's letter and memorandum

The Minister has expressed the economic and social objectives of the Crown for the province in two documents to the chief forester—a letter dated July 28, 1994 (attached as Appendix 3) and a memorandum dated February 26, 1996 (attached as Appendix 4).

This letter and memorandum provide a government view on forest stewardship, a stable timber supply, and allowance of time for communities to adjust to harvest-level changes in a managed transition from old-growth to second-growth forests, so as to provide for community stability.

The Minister stated in his letter of July 28, 1994, that 'any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability.' He placed particular emphasis on the importance of long-term community stability and the continued availability of good forest jobs. To this end he asked that the chief forester consider the potential impacts on timber supply of commercial thinning and harvesting in previously uneconomical areas in order to help maintain harvest levels. To encourage this, the Minister suggested consideration of partitioned AACs.

I reviewed commercial thinning under *incremental silviculture* and note that commercial thinning is not being undertaken in the TFL nor is assumed in the timber supply analysis. I have reviewed the operability assumptions in the timber supply analysis under *environmentally sensitive areas and operability* where it is noted that the TFL is highly operable relative to many other management units in the province. I am satisfied that assumptions made that define operability are based on the best information currently available. The timber supply analysis demonstrates that base case harvest levels can be maintained in the short-term without commercial thinning or harvesting in previously uneconomic areas. Given this information, I see no helpful reason to establish specific harvest levels attributable to particular areas, species, or terrains (i.e. partition) in this TFL at this time to address commercial thinning and previously uneconomic (inoperable) areas.

The Minister's memorandum addressed the effects of visual resource management on timber supply, asking that the constraints applied to timber supply to meet VQOs not be allowed to unreasonably restrict timber supply. As noted in *scenic areas*, the analysis addressed the timber supply impacts from established VQOs consistent with the direction provided in the Cabinet approved OS-LRMP. I am therefore satisfied this approach addresses the objectives expressed by the minister.

Local objectives

The Minister's letter of July 28, 1994, suggests that the chief forester should consider important social and economic objectives that may be derived from the public input in the timber supply review where these are consistent with government's broader objectives.

Local objectives for land and resource use in TFL 49 are largely captured in the Cabinet approved OS-LRMP (see *Okanagan Shuswap Land and Resource Management Plan*). I have accounted for these objectives as they relate to various factors that I have considered in my determination.

District staff shared with me the many comments received from First Nations that I discussed earlier under *First Nations considerations, and archaeological and cultural heritage resources*. I have taken these comments into account in my determination as they relate to the various factors that I have considered.

- (e) **abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.**

Forest health

Several biotic and abiotic factors can affect forest health. Forest stands are susceptible to a variety of damaging agents including wildfires, windthrow, disease and insects. Timber volume losses due to insects and diseases that normally affect stands (endemic losses) are generally measured and accounted for in the forest inventory and growth and yield estimates. Volumes lost due to abnormal events (epidemic losses) are addressed below under *unsalvaged losses*.

Insects of concern on the TFL other than the mountain pine beetle, which I discuss later, include western balsam bark beetles, spruce bark beetles and spruce budworm. Efforts

are made to try and control the spread of these insects through tools such as pheromone lures and single tree disposal for beetles, and aerial spraying of *Bacillus thuringiensis* to address the spruce budworm.

Root rot is also a significant concern in the TFL but no special accounting for this factor was undertaken in the analysis. The BCFS regional forest pathologist felt that the standard operational adjustment factors (OAFs) applied to managed stands for factors such as disease (OAF2s) in the analysis should be increased for TFL 49 due to diseases such as root rots.

The chief forester in the last AAC determination in 1998 requested that "the licensee work to compile more explicit information on root rots specific to TFL 49 before the next analysis". No work, however, has been undertaken. Under "Implementation", I reiterate the need for improved information to better account for this factor in support of future AAC determinations.

Unsalvaged losses

Unsalvaged losses are timber volumes destroyed or damaged, by such agents as fire or disease, that are not recovered through salvage operations. Estimates for unsalvaged losses account for epidemic (abnormal) infestations and for factors that result in losses that are not recovered through salvage harvest programs and are not recognized in yield estimates. Timber volume losses due to insects and diseases that normally affect stands (endemic losses) are accounted for in inventory sampling for existing timber yield estimation or through other methods. Endemic losses associated with second-growth stands are addressed by application of operational adjustment factors (OAFs) as noted under *volume estimates for regenerated managed stands*.

The licensee is well positioned to salvage many significant losses stemming from biotic and abiotic forest health factors given that the TFL has an extensive road network and highly operable terrain. Nevertheless, some unsalvaged losses do occur.

In the base case, the licensee assumed annual non-recoverable losses of 15 600 cubic metres per year based on an estimate of recent averages. This loss estimate was subtracted from the total harvest forecast. The annual losses are based on an estimated 12 800 cubic metres per year due to insects and 2800 cubic metres per year due to windthrow. No losses are assumed due to fire. Riverside indicates that losses from fire have been virtually eliminated from the TFL. Estimated unsalvaged losses are averages and reflect wide variations that can and do occur from year to year.

In the last determination in 1998, the chief forester instructed the licensee to "work to compile more local information on unsalvaged losses specific to this TFL". This work has yet to be undertaken. Recognizing that estimates provided on unsalvaged losses for this analysis are subject to some degree of uncertainty, under "Implementation" I request that the licensee obtain more accurate information on these losses in the TFL for use in subsequent timber supply reviews.

In the meantime, with the exception of the *mountain pine beetle epidemic* (discussed below), I am not aware of any better information to refine the estimates provided in the

analysis for unsalvaged losses and therefore accept their use as a reasonable basis for making this determination.

Mountain pine beetle epidemic

Mountain pine beetles are part of the natural process in lodgepole pine ecosystems. However, the current provincial outbreak has reached an unprecedented level in BC's history of recording such events. The 2005 aerial survey indicates 8.5 million hectares of the province are affected by the outbreak; this has increased from the seven million hectares affected in 2004 (which included four million hectares in the Southern Interior Forest Region). An immediate collapse of the beetle infestation does not appear likely since the recent trend of warm winters is expected to continue. BCFS staff project that by 2006, 50 percent of the merchantable lodgepole pine volume in BC's interior will be affected. This huge pine mortality affects available timber supply and habitat, and associated economic and environmental values.

The mountain pine beetle is significantly impacting lodgepole pine stands on TFL 49, particularly Block B. The TFL has been declared an Emergency Bark Beetle Management Area where the *Bark Beetle Regulation* under the Code applies that better enables the licensee to address the impacts of the epidemic.

Riverside currently gives harvest priority to recovering beetle-attacked stands in an effort to reduce additional unsalvaged losses resulting from the epidemic. About 75 percent of the last four years of harvesting has been directed to beetle-attacked stands or other salvage operations. During 2003, 85 percent of the harvest was directed to pine beetle attacked stands.

The BC Forest Service's Provincial Scale Mountain Pine Beetle Model predicts the spread of the beetle and projects the severity of stands attacked over time from trace, low, moderate, severe and very severe. Very severely attacked stands are projected to incur greater than 50 percent mortality while severely attacked stands are projected to sustain 31-50 percent mortality. The model's projection for 2004 was within 1 percent of the actual spread of the beetle infestation. The model was used along with TFL timber supply analysis data sets to estimate the impacts within the TFL over time.

Based on the model, the mountain pine beetle is projected to affect 2 832 778 cubic metres of timber volume in very severely attacked stands by the year 2010. In order to salvage this volume of projected very severely attacked lodgepole pine within the next five years, Riverside proposed an increase in the AAC of 200 000 cubic metres to 580 000 cubic metres. BCFS district staff support this request and agree it is needed to deal with the severity of the infestation in the TFL in a timely manner.

The mountain beetle is also projected to affect 1 419 448 cubic metres of timber volume in severely attacked stands by the year 2010. Very little harvesting is assumed in these stands for the first 5 years in order to give harvest priority to very severely attacked stands and to also allow the 50 to 69 percent of the volume in severely attacked stands attributable to non-pine species that are projected to survive to contribute to mid-term timber supply and stand- and landscape-level forest values.

Various analyses were undertaken to assess the impact of a 50 000, 100 000, 150 000, and 200 000 cubic metre annual increase in the harvest level for five years relative to the base case. For the proposed 200 000 cubic metre annual increase, the initial harvest level was set at 585 900 cubic metres per year for five years (i.e. 200 000 cubic metres per year plus the base case level of 385 900 cubic metres per year). After five years, the harvest level dropped to the 385 900 cubic metre base case level until the end of decade two. Mid-term levels then dropped five percent below the base case level to 365 000 cubic metres until a long-term harvest level of 488 900 cubic metres, similar to the base case, was attained in decade nine. Lower uplift scenarios resulted in correspondingly smaller impacts on mid-term harvest levels.

In these scenarios, susceptible stands targeted for harvest were greater than 40 percent pine, at least 80 years old and were within blocks A and B. Forest cover objectives for wildlife, visual quality, watersheds, and landscape-level biodiversity (old forest retention) were maintained as in the base case for all scenarios.

Riverside indicated that the shelf-life for recovering economic volume from infested pine stands is two years. In the beetle scenarios it was assumed that harvesting of pine mortality could continue over time with no finite shelf-life to economically recover affected volumes. In the adjacent Okanagan TSA, a five-year shelf life was assumed in various mountain pine beetle scenarios. The scenarios were all based on the BCFS Mountain Pine Beetle model projections to 2010.

Since in the beetle scenarios harvesting was directed at very severely attacked stands to recover losses, even the 200 000 cubic metre per year increase would not be sufficient to recover losses in less severely attacked stands. The expected non-recoverable pine mortality in these lesser-attacked stands is estimated to total 966 000 cubic metres. Assuming that harvesting of these stands in the beetle scenarios occurs after Riverside's estimate of economic shelf-life of two years, this non-recoverable pine volume equates to a 15 000 cubic metre per year overestimate of mid-term harvest levels in all scenarios. For the 200 000 cubic metre uplift scenario, that means that the mid-term harvest level is likely to be 350 000 cubic metres per year, which is nine percent below the mid-term harvest level attained in the base case and eight percent below the current AAC.

The Okanagan Shuswap Forest District *Mountain Pine Beetle Management Strategy* for salvage harvesting mountain pine beetle attacked stands, which may involve large cutblocks, is to increase retention levels in order to better provide for landscape- and stand-level biodiversity. Although increased retention levels were not explicitly assumed in the beetle scenarios, BC Forest Service staff believe this was accounted for by not harvesting less severely attacked stands.

After carefully reviewing this information, including the various beetle scenarios provided, and as I will discuss further under 'Reasons for Decision', I conclude that a harvest level of 580 000 cubic metre per year, consistent with the 200 000 cubic metre per year uplift scenario, is warranted to address the mountain pine beetle epidemic on the TFL for the next five years. This enables projected mortality in very severely attacked pine-leading stands to be recovered through harvesting and also helps ensure these areas are properly reforested, thereby providing future volumes of timber associated with regenerated managed stands. The 200 000 cubic metre per year uplift scenario, even as

adjusted to reflect volume losses in lesser attacked stands, still allows a reasonable mid-term level of harvest to be achieved and does not suggest the uplift would therefore cause undue impacts on mid-term timber supply.

Uplifts below 200 000 cubic metres per year, based on the projections, would mean substantial non-recoverable losses in very severely attacked stands. This can also affect future harvest levels if unharvested stands are not properly reforested and managed.

In 2004, the Forest Science Program of the BCFS prepared an interpretation paper entitled "Forest Stewardship in the Context of Large-scale Salvage Operations". The premise and recommendations of this paper were accepted by the BCFS and inform this determination. Increased harvesting operations lead to an increased risk to biodiversity, habitat and riparian integrity. This highlights the need for increased levels of retention to reduce the negative impacts on these values of a greater rate of harvesting. Since it is neither desirable nor possible to harvest all of the impacted pine forests, the paper recommends that at least 20 percent of the forest in affected areas be retained. On average, about 20 percent of the volume in very severely attacked stands consists of non-pine species. Although I accept an AAC uplift of 200 000 cubic metres as warranted to enable the salvage harvesting of very severely attacked stands by the mountain pine beetle, I encourage the licensee to retain as much of the non-pine as possible when harvesting these stands in order to provide both the increased retention needed when large scale salvage operations are undertaken, and to better provide for mid-term timber supply. Where it is not practical to retain the non-pine species, suitable pine should be retained. I note that the licensee is already doing watershed planning to retain suitable areas of non-pine, pine and areas with advanced regeneration.

I am also aware that the uplift scenarios are based on mortality projections up to 2010. If the spread of the beetle is not slowed by this increased harvesting capability, this can significantly affect timber supply on the TFL, and I am prepared to consider a new determination sooner than the five-year limit required by legislation.

Reasons for Decision

I have considered the information discussed throughout this document, and I have reasoned as follows.

The 2004 timber supply analysis base case projection indicates an initial harvest level of 385 900 cubic metres can be sustained for 70 years. This initial harvest level is 1.6 percent higher than the current AAC of 380 000 cubic metres. The harvest forecast then increases by 27 percent to the long-term level of 488 600 cubic metres in decade eight.

In determining AACs, my considerations typically identify factors which, considered separately, indicate reasons why the timber supply may be either greater or less than the harvest levels projected for various periods in the base case. Some of these factors can be quantified and their implications assessed with reliability. Others may influence the assessment of the timber supply by introducing an element of risk or uncertainty, but cannot be quantified reliably at the time of the determination and must be accounted for in more general terms.

In my considerations, I identified the following factor as a reason why the timber supply projected in the base case may have been overestimated:

- *Roads, trails and landings:* the assumed widths for roads and trails used in the analysis likely resulted in an overestimate of the timber harvesting land base and I therefore consider timber supply to have been overestimated by 1.4 percent in the base case over the harvest forecast period. I further consider long term timber supply to have been overestimated in the base case by an additional 0.4 percent due to a similar underestimate of the area that will be covered by future roads and trails.

After carefully examining each of the relevant factors under section 8 of the *Forest Act*, I concluded that the assumptions underlying the other factors that form the basis of the base case are suitable for use in this determination and that no adjustments to the AAC I determine are necessary on their account.

In making this determination, I am particularly mindful of the projection from the BC Forest Service's Provincial Scale Mountain Pine Beetle Model that by the year 2010, 2 832 778 cubic metres of pine-leading stands are expected to be very severely attacked by the mountain pine beetle, with mortality exceeding 50 percent. With shelf life estimates ranging from two to five years, much of this volume would no longer be economic for harvest if the AAC were maintained at the current level for the next five years. Riverside has proposed to harvest these stands over the next five years, and this could be accomplished with a harvest level of about 580 000 cubic metres per year, equivalent to Riverside's 200 000 cubic metre per year uplift scenario.

I am aware that at Riverside's proposed harvest level of 580 000 cubic metres per year, the mid-term harvest level is projected to be in the range of from 350 000 cubic metres per year to 365 000 cubic metres per year, depending on the actual level of infestation experienced in the less severely attacked stands and Riverside's success at salvaging these stands after 2010. Even at the lower estimate of the mid-term harvest level, this represents only an eight percent reduction from the current AAC, and I find this is not unreasonable considering the severity of the mountain pine beetle epidemic on the TFL. I further note that in the 200 000 cubic metre per year uplift scenario, all forest cover constraints assumed in the base case for wildlife, visual quality, watersheds, and landscape-level biodiversity (old forest retention) were applied.

I am also aware that BCFS district staff support the proposed harvest level and indicate it is necessary to deal with the severity of the infestation on the TFL in a timely manner.

Having reviewed all the available information, I agree with Riverside's and District staff's assessment. I find the mountain pine beetle epidemic to be the overriding factor, eclipsing all other factors in this determination for TFL 49, including the above-noted overestimate of timber supply associated with the assumptions applied in the base case for roads. I further agree that harvesting the stands projected to be very severely attacked by 2010 in a timely manner is a priority for TFL 49 so that affected stems are not rendered uneconomic for harvest and processing and managed forests can be regenerated on affected areas.

In my considerations above I noted the concern that increased harvesting operations lead to an increased risk to biodiversity, habitat and riparian integrity. On average, about 20 percent of the volume in very severely attacked stands consists of non-pine species. This component of the stands needs to be retained where feasible to provide both the increased retention needed when large scale salvage operations are undertaken, and to better provide for mid-term timber supply. I therefore encouraged the licensee to retain as much of the non-pine species as possible when harvesting.

I am aware that First Nations with asserted traditional territories on the TFL were consulted as part of the timber supply review process that supported this determination. One band expressed a desire to protect birch stands. This determination should not affect the future availability of birch stands for cultural purposes since all deciduous-leading stands and the deciduous component of coniferous-leading stands were excluded from contributing to the base case harvest projection. I am also aware that a Traditional Use Study is underway in the Tahaetkun Mountain area and I will review this as well as Riverside's management strategies around this area when this information is available, to assess potential effects on the timber supply of TFL 49. If these results, or any other new information about traditional use or aboriginal interests, significantly vary from the assumptions made in this determination, I am prepared to revisit this determination sooner than the five years required by legislation.

Determination

I have considered and reviewed all the factors as documented above, including the risks and uncertainties in the information provided. It is my determination that a timber harvest level that accommodates objectives for all forest resources during the next five years and that reflects current management practices as well as the socio-economic objectives of the Crown, and the need to address the mountain pine beetle epidemic, can be best achieved on TFL 49 by establishing an AAC of 580 000 cubic metres.

This determination is effective December 5, 2005, and will remain in effect until a new AAC is determined, which must take place within five years of the effective date of this determination.

If significant new information is made available to me, major changes occur in the management assumptions upon which I have predicated this decision, or the mountain pine beetle outbreak progresses substantially differently than assumed in support of this decision, then I am prepared to revisit this determination sooner than the five years required by legislation.

Implementation

In the period following this decision and leading to the subsequent determination, I encourage the licensee to undertake the tasks and studies noted below that I have also described further in the appropriate sections of this rationale document. I recognize that the ability of the licensee to undertake these projects is dependent on available resources including funding. However, the importance of completing many of the tasks listed below were identified in the last determination and much of the work is still outstanding.

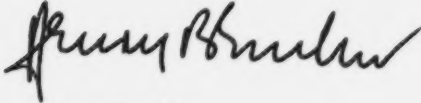
I must emphasize that completing these projects will help reduce the risk and uncertainty associated with key factors that affect the future timber supply in TFL 49.

- *Roads, trails and landings:* provide information in the analysis for the next determination that will confirm road-widths assumed in the base case.
- *Environmentally sensitive areas and operability:* the licensee has a project underway to upgrade terrain stability information for the TFL. I encourage the licensee to complete this project so that better information is available to account for unstable soils in support of the next determination.
- *Riparian management areas:* the licensee states in its Management Plan that it is committed to completing an inventory of streams, wetlands and lakes to *Riparian Management Area Guidebook* standards. I urge completion of this task so that the timber supply implications associated with riparian management can be fully accounted for in the next timber supply analysis.
- *Volume estimates for regenerated managed stands:* the licensee applied non-standard operational adjustment factors (OAFs) when estimating volumes for managed stands, yet provided no explicit documentation substantiating the use of lower OAF 1 reductions. I am concerned about the potential for overestimation of managed stand yields stemming from this factor and its effect on mid-term timber supply. I therefore request, as the chief forester did in the 1998 determination, that the licensee further examine and refine OAF adjustments before the next analysis.
- *Forest health:* The chief forester in the 1998 AAC determination requested that "the licensee work to compile more explicit information on root rots specific to TFL 49 before the next analysis". No work, however, has been brought to my attention by the licensee. In the aftermath of the mountain pine beetle epidemic, greater dependency will be placed on non-pine species, and on the performance of managed stands in the mid-term. For both instances, forest health assumptions will be important and I request that the licensee address this issue before the next determination.
- *Unsalvaged losses:* I encourage the licensee to obtain more accurate information on these losses so that they can be better estimated in support of future determinations.

Several factors improved the base case in this timber supply analysis relative the previous analysis including:

- Vegetation Resource Inventory (VRI) phase 2 work leading to an average volume increase of 9.3 percent for mature natural stands;
- improved site index estimates resulting in an average 26 percent increase in expected volumes from managed stands;
- volume gains from genetic improvement ranging from 12 to 16 percent applied to future managed stand yield tables; and
- a 1.9 percent increase in all yield tables to reflect higher levels of utilization (i.e. 20 cm stump height at harvest).

Since the AAC that I have determined is predicated on these assumptions, I request that these factors be monitored to ensure they remain appropriate for use in future determinations.

A handwritten signature in black ink, appearing to read "Henry Benskin", with a stylized flourish at the end.

Henry Benskin
Deputy Chief Forester

December 5, 2005

Appendix 1: Section 8 of the *Forest Act*

Section 8 of the *Forest Act*, Revised Statutes of British Columbia 1996, c. 157
Consolidated to October 21, 2004, reads as follows:

Allowable annual cut

- 8 (1) The chief forester must determine an allowable annual cut at least once every 5 years after the date of the last determination, for
 - (a) the Crown land in each timber supply area, excluding tree farm licence areas, community forest areas and woodlot licence areas, and
 - (b) each tree farm licence area.
- (2) If the minister
 - (a) makes an order under section 7 (b) respecting a timber supply area, or
 - (b) amends or enters into a tree farm licence to accomplish the result set out under section 39 (2) or (3),the chief forester must make an allowable annual cut determination under subsection (1) for the timber supply area or tree farm licence area
 - (c) within 5 years after the order under paragraph (a) or the amendment or entering into under paragraph (b), and
 - (d) after the determination under paragraph (c), at least once every 5 years after the date of the last determination.
- (3) If
 - (a) the allowable annual cut for the tree farm licence area is reduced under section 9 (3), and
 - (b) the chief forester subsequently determines, under subsection (1) of this section, the allowable annual cut for the tree farm licence area,the chief forester must determine an allowable annual cut at least once every 5 years from the date the allowable annual cut under subsection (1) of this section is effective under section 9 (6).
- (3.1) If, in respect of the allowable annual cut for a timber supply area or tree farm licence area, the chief forester considers that the allowable annual cut that was determined under subsection (1) is not likely to be changed significantly with a new determination, then, despite subsections (1) to (3), the chief forester
 - (a) by written order may postpone the next determination under subsection (1) to a date that is up to 10 years after the date of the relevant last determination, and
 - (b) must give written reasons for the postponement.
- (3.2) If the chief forester, having made an order under subsection (3.1), considers that because of changed circumstances the allowable annual cut that was determined under subsection (1) for a timber supply area or tree farm licence area is likely to be changed significantly with a new determination, he or she

- (a) by written order may rescind the order made under subsection (3.1) and set an earlier date for the next determination under subsection (1), and
 - (b) must give written reasons for setting the earlier date.
- (4) If the allowable annual cut for the tree farm licence area is reduced under section 9 (3), the chief forester is not required to make the determination under subsection (1) of this section at the times set out in subsection (1) or (2) (c) or (d), but must make that determination within one year after the chief forester determines that the holder is in compliance with section 9 (2).
- (5) In determining an allowable annual cut under subsection (1) the chief forester may specify portions of the allowable annual cut attributable to
 - (a) different types of timber and terrain in different parts of Crown land within a timber supply area or tree farm licence area, and
 - (b) different types of timber and terrain in different parts of private land within a tree farm licence area,
 - (c) [Repealed 1999-10-1.]
- (6) The regional manager or district manager must determine an allowable annual cut for each woodlot licence area, according to the licence.
- (7) The regional manager or the regional manager's designate must determine a an allowable annual cut for each community forest agreement area, in accordance with
 - (a) the community forest agreement, and
 - (b) any directions of the chief forester.
- (8) In determining an allowable annual cut under subsection (1) the chief forester, despite anything to the contrary in an agreement listed in section 12, must consider
 - (a) the rate of timber production that may be sustained on the area, taking into account
 - (i) the composition of the forest and its expected rate of growth on the area,
 - (ii) the expected time that it will take the forest to become re-established on the area following denudation,
 - (iii) silviculture treatments to be applied to the area,
 - (iv) the standard of timber utilization and the allowance for decay, waste and breakage expected to be applied with respect to timber harvesting on the area,
 - (v) the constraints on the amount of timber produced from the area that reasonably can be expected by use of the area for purposes other than timber production, and
 - (vi) any other information that, in the chief forester's opinion, relates to the capability of the area to produce timber,
 - (b) the short and long term implications to British Columbia of alternative rates of timber harvesting from the area,
 - (c) Repealed [2003-31-02]

- (d) the economic and social objectives of the government, as expressed by the minister, for the area, for the general region and for British Columbia, and
- (e) abnormal infestations in and devastations of, and major salvage programs planned for, timber on the area.

Appendix 2: Section 4 of the *Ministry of Forests Act*

Section 4 of the *Ministry of Forests Act* (consolidated 1988) reads as follows:

Purposes and functions of ministry

4. The purposes and functions of the ministry are, under the direction of the minister, to
 - (a) encourage maximum productivity of the forest and range resources in British Columbia;
 - (b) manage, protect and conserve the forest and range resources of the government, having regard to the immediate and long term economic and social benefits they may confer on British Columbia;
 - (c) plan the use of the forest and range resources of the government, so that the production of timber and forage, the harvesting of timber, the grazing of livestock and the realization of fisheries, wildlife, water, outdoor recreation and other natural resource values are co-ordinated and integrated, in consultation and co-operation with other ministries and agencies of the government and with the private sector;
 - (d) encourage a vigorous, efficient and world competitive timber processing industry in British Columbia; and
 - (e) assert the financial interest of the government in its forest and range resources in a systematic and equitable manner.

Documents attached:

Appendix 3: Minister's letter of July 28, 1994

Appendix 4: Minister's memo of February 26, 1996



File: 10100-01

JUL 28 1994

John Cuthbert
Chief Forester
Ministry of Forests
595 Pandora Avenue
Victoria, British Columbia
V8W 3E7

Dear John Cuthbert:

Re: Economic and Social Objectives of the Crown

The *Forest Act* gives you the clear responsibility for determining Allowable Annual Cuts, decisions with far-reaching implications for the province's economy. The *Forest Act* provides that you consider the social and economic objectives of the Crown, as expressed by me, in making these determinations. The purpose of this letter is to provide this information to you.

The social and economic objectives expressed below should be considered in conjunction with environmental considerations as reflected in the Forest Practices Code, which requires recognition and better protection of non-timber values such as biodiversity, wildlife and water quality.

The government's general social and economic objectives for the forest sector are made clear in the goals of the Forest Renewal Program. In relation to the Allowable Annual Cut determinations you must make, I would emphasize the particular importance the government attaches to the continued availability of good forest jobs and to the long-term stability of communities that rely on forests.

Through the Forest Renewal Plan, the government is taking the steps necessary to facilitate the transition to more value-based management in the forest and the forest sector. We feel that adjustment costs should be minimized wherever possible, and to this end, any decreases in allowable cut at this time should be no larger than are necessary to avoid compromising long-run sustainability.

.../2

Province of
British Columbia

Minister of
Forests

Parliament Buildings
Victoria, British Columbia
V8V 1X4

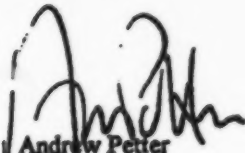
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John Cuthbert
Page 2

In addition to the provincial perspective, you should also consider important local social and economic objectives that may be derived from the public input on the Timber Supply Review discussion papers where these are consistent with the government's broader objectives.

Finally, I would note that improving economic conditions may make it possible to harvest timber which has typically not been used in the past. For example, use of wood from commercial thinnings and previously uneconomic areas may assist in maintaining harvests without violating forest practices constraints. I urge you to consider all available vehicles, such as partitioned cuts, which could provide the forest industry with the opportunity and incentive to demonstrate their ability to utilize such timber resources.

Yours truly,



Andrew Petter
Minister



Province of
British Columbia

OFFICE OF THE
MINISTER

Ministry of
Forests



MEMORANDUM

File: 16290-01

February 26, 1996

To: Larry Pedersen
Chief Forester

From: The Honourable Andrew Petter
Minister of Forests

Re: The Crown's Economic And Social Objectives Regarding Visual Resources

Further to my letter of July 29, 1994, to your predecessor, wherein I expressed the economic and social objectives of the Crown in accordance with Section 7 of the *Forest Act*, I would like to elaborate upon these objectives as they relate to visual resources.

British Columbia's scenic landscapes are a part of its heritage and a resource base underlying much of its tourism industry. They also provide timber supplies that are of significant economic and social importance to forest industry dependent communities.

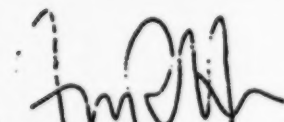
Accordingly, one of the Crown's objectives is to ensure an appropriate balance within timber supply areas and tree farm licence areas between protecting visual resources and minimizing the impact of such protection measures on timber supplies.

As you know, I have directed that the policy on management of scenic landscapes should be modified in light of the beneficial effects of the Forest Practices Code. In general, the new policy should ensure that establishment and administration of visual quality objectives is less restrictive on timber harvesting. This change is possible because alternative harvesting approaches as well as overall improvement in forest practices will result in reduced detrimental impacts on visually sensitive areas. Also, I anticipate that the Forest Practices Code will lead to a greater public awareness that forest harvesting is being conducted in a responsible, environmentally sound manner, and therefore to a decreased public reaction to its visible effects on the landscape. In relation to the Allowable Annual Cuts determinations that you make, please consider the effects that the new policy will have in each Timber Supply Area and Tree Farm Licence.

Larry Pedersen
Page 2

In keeping with my earlier letter, I would re-emphasize the Crown's objectives to ensure community stability and minimize adjustment costs as the forest sector moves to more value-based management. I believe that the appropriate balance between timber and visual resources will be achieved if decisions are made consistent with the ministry's February 1996 report *The Forest Practices Code: Timber Supply Analysis*.

Finally, in my previous letter I had asked that local economic and social objectives be considered. Please ensure that local views on the balance between timber and visual resources are taken into account within the context of government's broader objectives.

A handwritten signature in dark ink, appearing to read 'Andrew Petter', is written over the printed name.

Andrew Petter
Minister of Forests

